

WHAT IS CLAIMED

1. A color separation circuit of a single chip color camera for subjecting a signal from a solid-state image pick-up device having a plurality of types of color filters which differ in spectral sensitivity characteristics arranged therein, respectively, so as to correspond to pixels to color separation processing, comprising:

a plurality of types of interpolation processing means for respectively producing a plurality of chrominance signal components at the arbitrary pixel to be processed and suitable for a case where there is a strong correlation in each of a plurality of types of directions centered at the pixel to be processed from the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed;

correlated value detection means for detecting the direction in which there is a strong correlation out of the plurality of types of directions centered at the pixel to be processed on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed; and

means for finding the plurality of chrominance

signal components at said pixel to be processed on the basis of the direction in which there is a strong correlation which is detected by the correlated value detection means and each of the chrominance signal components produced by the interpolation processing means,

gain control means for controlling a gain for each of the color filters being provided in a stage preceding the correlated value detection means,

the correlated value detection means detecting the direction in which there is a strong correlation out of the plurality of types of directions centered at the pixel to be processed on the basis of signals at all the pixels in a block composed of M by N pixels centered at the pixel to be processed which are inputted through the gain control means.

2. The color separation circuit of the single chip color camera according to claim 1, wherein the gain control means carries out the gain control on the basis of color information obtained from the whole of a screen.

3. The color separation circuit of the single chip color camera according to claim 2, wherein the color filter arranged in the solid-state image pick-up device is a primary color filter, and

the gain control means is also used as white balance processing means in the color camera.

4. The color separation circuit of the single chip color camera according to claim 2, wherein

each of the interpolation means calculates the plurality of chrominance signal components at the pixel to be processed on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed after the gain control processing is performed by the gain control means.

5. The color separation circuit of the single chip color camera according to claim 1, wherein

the gain control means divides a screen into a plurality of areas, and performs the gain control processing for each of the areas.

6. A color separation circuit of a single chip color camera for subjecting a signal from a solid-state image pick-up device having a plurality of types of color filters which differ in spectral sensitivity characteristics arranged therein, respectively, so as to correspond to pixels to color separation processing, comprising:

first interpolation processing means for producing a plurality of chrominance signal

components at the arbitrary pixel to be processed and suitable for a case where there is a strong correlation in the horizontal direction at the pixel to be processed from chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed;

second interpolation processing means for producing a plurality of chrominance signal components at the pixel to be processed and suitable for a case where there is a strong correlation in the vertical direction at the pixel to be processed from the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed;

correlated value calculation means for calculating correlated values in the horizontal direction and the vertical direction at the pixel to be processed on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed; and

weighting and addition means for weighting each of the chrominance signal components produced by the first interpolation processing means, weighting each of the chrominance signal components produced by the second interpolation processing means, and

adding the weighted chrominance signal components depending on the correlated values in the horizontal direction and the vertical direction which are calculated by the correlated value calculation means, to find the plurality of chrominance signal components at the pixel to be processed,

gain control means for controlling a gain for each of the color filters being provided in a stage preceding the correlated value detection means,

the correlated value calculation means calculating the correlated values in the horizontal direction and the vertical direction at the pixel to be processed on the basis of signals at all the pixels in a block composed of M by N pixels centered at the pixel to be processed which are inputted through the gain control means.

7. The color separation circuit of the single chip color camera according to claim 6, wherein

the gain control means carries out the gain control on the basis of color information obtained from the whole of a screen.

8. The color separation circuit of the single chip color camera according to claim 7, wherein

the color filter arranged in the solid-state image pick-up device is a primary color filter, and

the gain control means is also used as white balance processing means in the color camera.

9. The color separation circuit of the single chip color camera according to claim 7, wherein

the first interpolation means and the second interpolation means calculate a plurality of chrominance signal components at the pixel to be processed on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed after the gain control processing is performed by the gain control means.

10. The color separation circuit of the single chip color camera according to claim 6, wherein

the gain control means divides a screen into a plurality of areas, and performs the gain control processing for each of the areas.

11. In a color separation circuit of a single chip color camera for processing a signal from a solid-state image pick-up device having a plurality of types of color filters which differ in spectral sensitivity characteristics arranged in a Mosaic shape therein, respectively, so as to correspond to pixels through an automatic gain control circuit for carrying out gain control, the color separation

circuit of the single chip color camera, comprising:

two or more types of color separation means, which differ in a chrominance signal component producing system, provided in order to produce a plurality of chrominance signal components at the arbitrary pixel to be processed on the basis of chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed; and

synthesis means for synthesizing the chrominance signal components respectively produced by the color separation means on the basis of the signal from the solid-state image pick-up device.

12. The color separation circuit of the single chip color camera according to claim 11, wherein the synthesis means synthesizes the chrominance signal components produced by the respective color separation means on the basis of the level of the signal from the solid-state image pick-up device.

13. The color separation circuit of the single chip color camera according to claim 11, wherein the synthesis means synthesizes the chrominance signal components produced by the

respective color separation means on the basis of the gain, of the automatic gain control circuit, corresponding to the level of the signal from the solid-state image pick-up device.

14. The color separation circuit of the single chip color camera according to claim 11, wherein primary color correlated color separation means for producing a plurality of chrominance signal components at the arbitrary pixel to be processed utilizing the correlation of the ratio of colors in the horizontal direction or the vertical direction on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed and color difference correlated color separation means for producing the plurality of chrominance signal components at the arbitrary pixel to be processed utilizing the correlation of the difference between colors in the horizontal direction or the vertical direction on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed are provided as the color separation means, and

the synthesis means synthesizes the chrominance signal components produced by both the

color separation means such that each of the chrominance signal components produced by the primary color correlated color separation means is increased when the level of the signal from the solid-state image pick-up device is high, while synthesizing the chrominance signal components produced by both the color separation means such that each of the chrominance signal components produced by the color difference correlated color separation means is increased when the level of the signal from the solid-state image pick-up device is low.

15. The color separation circuit of the single chip color camera according to claim 11, wherein primary color correlated color separation means for producing a plurality of chrominance signal components at the arbitrary pixel to be processed utilizing the correlation of the ratio of colors in the horizontal direction or the vertical direction on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed, and color difference correlated color separation means for producing the plurality of chrominance signal components at the arbitrary pixel to be processed utilizing the correlation of the difference between

colors in the horizontal direction or the vertical direction on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed are provided as the color separation means, and

the synthesis means synthesizes the chrominance signal components produced by both the color separation means such that each of the chrominance signal components produced by the color difference correlated color separation means is increased when the gain, of the automatic gain control circuit, corresponding to the level of the signal from the solid-state image pick-up device is large, while synthesizing the chrominance signal components produced by both the color separation means such that each of the chrominance signal components produced by the primary color correlated color separation means is increased when the gain of the automatic gain control circuit is small.

16. The color separation circuit of the single chip color camera according to claim 14, further comprising

correlated value detection means for finding correlated values in the horizontal direction and the vertical direction at the pixel to be processed,

each of the primary color correlated color separation means and the color difference correlated color separation means comprising horizontal direction processing means for producing a chrominance signal component suitable for a case where there is a strong correlation in the horizontal direction and vertical direction processing means for producing a chrominance signal component suitable for a case where there is a strong correlation in the vertical direction,

each of the primary color correlated color separation means and the color difference correlated color separation means weighting each of the chrominance signal components produced by the horizontal direction processing means, weighting each of the chrominance signal components produced by the vertical direction processing means, and adding the weighted chrominance signal components depending on the correlated values in the horizontal direction and the vertical direction which are detected by the correlated value detection means, to find a plurality of chrominance signal components at the pixel to be processed.

17. The color separation circuit of the single chip color camera according to claim 15, further

comprising

correlated value detection means for finding correlated values in the horizontal direction and the vertical direction at the pixel to be processed,

each of the primary color correlated color separation means and the color difference correlated color separation means comprising horizontal direction processing means for producing a chrominance signal component suitable for a case where there is a strong correlation in the horizontal direction and vertical direction processing means for producing a chrominance signal component suitable for a case where there is a strong correlation in the vertical direction,

each of the primary color correlated color separation means and the color difference correlated color separation means weighting each of the chrominance signal components produced by the horizontal direction processing means, weighting each of the chrominance signal components produced by the vertical direction processing means, and adding the weighted chrominance signal components depending on the correlated values in the horizontal direction and the vertical direction which are detected by the correlated value detection means,

to find a plurality of chrominance signal components at the pixel to be processed.

18. The color separation circuit of the single chip color camera according to claim 11, wherein

adaptive correlated color separation means for producing a plurality of chrominance signal components at the arbitrary pixel to be processed utilizing the correlation of the difference between colors in the direction in which there is a strong correlation out of the horizontal direction and the vertical direction, while utilizing the correlation of the ratio of colors in the direction in which there is a weak correlation on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed, and color difference correlated color separation means for producing the plurality of chrominance signal components at the arbitrary pixel to be processed utilizing the correlation of the difference between colors in the horizontal direction or the vertical direction on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed are provided as the color separation means, and

the synthesis means synthesizes the

chrominance signal components produced by both the color separation means such that each of the chrominance signal components produced by the adaptive correlated color separation means is increased when the level of the signal from the solid-state image pick-up device is high, while synthesizing the chrominance signal components produced by both the color separation means such that each of the chrominance signal components produced by the color difference correlated color separation means is increased when the level of the signal from the solid-state image pick-up device is low.

19. The color separation circuit of the single chip color camera according to claim 11, wherein adaptive correlated color separation means for producing a plurality of chrominance signal components at the arbitrary pixel to be processed utilizing the correlation of the difference between colors in the direction in which there is a strong correlation out of the horizontal direction and the vertical direction, while utilizing the correlation of the ratio of colors in the direction in which there is a weak correlation on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed, and

color difference correlated color separation means for producing the plurality of chrominance signal components at the arbitrary pixel to be processed utilizing the correlation of the difference between colors in the horizontal direction or the vertical direction on the basis of the chrominance signal components at the pixel to be processed and the pixels around the pixel to be processed are provided as the color separation means, and

the synthesis means synthesizes the chrominance signal components produced by both the color separation means such that each of the chrominance signal components produced by the color difference correlated color separation means is increased when the gain, of the automatic gain control circuit, corresponding to the level of the signal from the solid-state image pick-up device is large, while synthesizing the chrominance signal components produced by both the color separation means such that each of the chrominance signal components produced by the adaptive correlated color separation means is increased when the gain of the automatic gain control circuit is small.

20. The color separation circuit of the single chip color camera according to claim 18, further

comprising

correlated value detection means for finding correlated values in the horizontal direction and the vertical direction at the pixel to be processed,

each of the adaptive correlated color separation means and the color difference correlated color separation means comprising horizontal direction processing means for producing a chrominance signal component suitable for a case where there is a strong correlation in the horizontal direction and vertical direction processing means for producing a chrominance signal component suitable for a case where there is a strong correlation in the vertical direction,

each of the adaptive correlated color separation means and the color difference correlated color separation means weighting each of the chrominance signal components produced by the horizontal direction processing means, weighting each of the chrominance signal components produced by the vertical direction processing means, and adding the weighted chrominance signal components depending on the correlated values in the horizontal direction and the vertical direction which are detected by the correlated value detection means,

to find the plurality of chrominance signal components at the pixel to be processed.

21. The color separation circuit of the single chip color camera according to claim 19, further comprising

correlated value detection means for finding correlated values in the horizontal direction and the vertical direction at the pixel to be processed,

each of the adaptive correlated color separation means and the color difference correlated color separation means comprising horizontal direction processing means for producing a chrominance signal component suitable for a case where there is a strong correlation in the horizontal direction and vertical direction processing means for producing a chrominance signal component suitable for a case where there is a strong correlation in the vertical direction,

each of the adaptive correlated color separation means and the color difference correlated color separation means weighting each of the chrominance signal components produced by the horizontal direction processing means, weighting each of the chrominance signal components produced by the vertical direction processing means, and

adding the weighted chrominance signal components depending on the correlated values in the horizontal direction and the vertical direction which are detected by the correlated value detection means, to find the plurality of chrominance signal components at the pixel to be processed.

1. A method for processing a pixel, comprising:
 receiving a pixel value;
 detecting a correlated value in a horizontal direction;
 detecting a correlated value in a vertical direction;
 adding a weighted chrominance signal component, based on the correlated value in the horizontal direction, to the pixel value;
 adding a weighted chrominance signal component, based on the correlated value in the vertical direction, to the pixel value;
 outputting the pixel value.